PATENT

MID-FOOT STABILIZATION SYSTEM FOR FOOTWEAR

Field of the Invention

The present invention relates to footwear, and in particular, to strapping systems for securely affixing footwear to a user's foot.

Background of the Invention

There is a wide variety of prior art showing strapping configurations for footwear. Generally, the purpose of such strapping may be summarized as securing the footwear to a user's foot. Such strapping is often used in connection with sandals.

Examples of prior US Patents showing sandal or footwear strapping arrangements include U.S. Patents Nos. 4,200,997 and 4,446,633 to Scheinhaus, U.S. Patent No. 4,817,302 to Saltsman, U.S. Patent No. 4,300,294 Riecken, U.S. Patent No. 2,788,591 to Gibson, U.S. Patent No. 2,126,094 to Daniels, and U.S. Patent No. 2,862,311 to Ellis. Each of these patents disclose a strapping configuration that engages the ankle, heel, instep, toes, arch, or some combination thereof to secure the footwear to the user's foot. None of these prior art disclosures, however, nor any other existing strapping configurations have been entirely satisfactory in securing footwear to the foot, while maintaining a comfortable, durable, and convenient configuration.

This problem is particularly acute for sandals used in sports or other vigorous activities. As sandals have become more frequently worn in these active endeavors, demands on strapping configurations have grown. No existing sandal strapping configuration adequately minimizes movement of the sandal sole with respect to the foot while allowing for required natural foot movement, user comfort, ease of use, and cost of manufacture.

One particular problem that many prior art configurations suffer from relates to an ankle strap. As the angle between the foot and the ankle changes during normal walking or running, the foot's main tendon that travels down the front of the leg and across the instep of the foot is cyclically tightened and loosened. This causes the overall circumference of the ankle and instep to increase and decrease. Any strapping that wraps the ankle must allow for this expansion and contraction, which necessitates such strapping to incorporate a certain tolerance. Without such allowance, ankle strapping restricts foot movement. Thus an effective, tight fit is not possible with an ankle strap.

Ankle straps are connected to the sole near the heel or rear of the sole, and thereby exert force on the heel. This may cause a slower response to foot movement by the sole.

Another problem results from the use of strapping configurations that offer only limited contact with foot sections. For instance, some prior strapping configurations contact the foot only along a transverse axis. As forces associated with foot movement may occur along the longitudinal axis of the foot, as well as in all other directions, such transverse oriented strapping is limited in its ability to secure the foot to the sole.

Footwear straps are typically oriented in a direction that does not correspond to the force vectors that occur during walking, running, or vigorous activity. Strapping usually is oriented at an angle of approximately 90° from the sole. This angle is appropriate to maximize strapping strength only when the strap lies flat and parallel to the sole on the foot surface. As the top of the foot slopes forward, however, a strap oriented at a 90° angle form the sole must twist to lie flat on the sloping foot surface. This causes discomfort in the user and diminishes the strength capacity of the strap.

During normal walking or running, the foot moves in an upward and forward motion, and correspondingly pulls the sole in this direction. A strap oriented at a 90° angle to the sole, however, is positioned to be at its peak strength and comfort to the user for forces directed straight upwards. These straps are therefore disadvantageous for use with a natural foot movement.

Another problem existing with many prior art sandal strapping configurations is the point of connection of the strapping to the sole. Strapping that is connected at isolated points can only secure the foot to these isolated points. Often, the point of stress is at the surface of the sole and tends to be near the front or rear edges of the sole. Because the sole is inherently flexible, securing strapping to these isolated, static points inevitably leads to bending and unequal movement of the sole with reference to the foot, particularly during vigorous movement.

Other existing strapping configurations are such that they do not allow for natural movement of the foot to occur as may occur during sports or the like. They are configurations that may be sufficient to secure the sole to the foot when stationary, but are

incapable of adjusting as the foot may change shape slightly during movement, or as forces occur in a variety of directions during vigorous activity.

Still other prior art footwear strapping configurations feature a continuos strap that contacts the wearer's foot in multiple locations, such as around the ankle, across the instep, and over the front of the foot. Such straps cannot be snugly fit to a single portion of the wearer's foot, as they must allow for movement of other portions of the foot. A continuous strap that covers both the instep and the forefoot, for instance, may develop looseness over the instep due to movement of the forefoot.

An unresolved need therefore exists for footwear featuring a strapping configuration that securely fixes the sole to the foot and accommodates the wide range of forces developed during sports or other vigorous activities. Further, a need exists for strapping that is capable of dynamically adjusting itself as required during such use.

Objects of the Invention

It is an object of the invention to provide footwear with a strapping configuration that effectively and securely binds the footwear to a user's foot, even during sports or other vigorous activity.

It is a further object of the invention to provide footwear with a dynamically self adjusting strapping configuration for securing the footwear to the user's instep.

Summary of the Invention

The present invention comprises a unique strapping configuration for footwear that provides for dynamic fit adjustment while securely and comfortably affixing a sole to a wearer's foot. The strapping generally includes an adjustable X configuration strap that has both ends attached to a heel portion of the footwear, crosses over the wearer's instep, and passes through a transverse channel in the midsole of the footwear under the wearer's arch. The present invention further comprises footwear incorporating the unique strapping configuration that securely fastens the footwear to the user's foot, even during sports or other vigorous activities.

The adjustable X configuration instep strap generally has a first end secured to a first side of the heel portion of the footwear, crosses forwardly and transversely over the wearer's instep, passes through a channel in the sole of the footwear at the midfoot, near the longitudinal center of the sole, extends rearwardly and transversely back across the wearer's instep (thereby forming an X over the instep), and is adjustably and releasably secured to the second side of the heel portion of the footwear. Preferably, the channel is angled downwardly from rear to front in the longitudinal direction, parallel to the downward slope of the wearer's instep, so that the strap will lie flat on the wearer's instep, and thereby more evenly carry forces that develop between the foot and the sole during sports or other vigorous activities.

The X configuration instep strap acts to secure the entire circumference of a wearer's foot to the footwear sole. The strap passes under the wearer's arch through the midfoot channel, and thereby works to secure the entire transverse midfoot portion of the

sole to the bottom of the wearer's foot. Further, the strap as it passes through the channel operates to force the sole upward from near its center of gravity. This offers improvement over prior art configurations that attach strapping only to the top surface of the sole, and improvement over prior art configurations that have straps attached only at isolated points on the sole surface away from the center of gravity and longitudinal center of the footwear.

To provide for a fluid, changing fit, the potion of the footwear sole through which the midfoot channel passes, the midfoot shank, is comprised of a relatively stiff and hard material that will not significantly compress and thereby not pinch the strap passing through it during use. The strap is thus free to move through the channel as the wearer's foot moves in different directions, thereby achieving a constantly adjusted fit. The preferred midfoot shank is preferably manufactured separate from the sole and is affixed thereto by molding or with an adhesive. This allows for the shank including the midfoot channel to be constructed of a relatively hard and stiff material and be conveniently attached to a softer, more pliable sole.

The relatively stiff midfoot shank also functions as a standard shank to add desirable stiffness and torsional rigidity to the sole.

The top of the X configuration strap is positioned to lie over the instep of a wearer's foot. It is therefore forward on the foot from the ankle, and leaves the ankle free from circumferential restriction so it may freely expand and contract as the foot's main tendon tightens and loosens. This is of particular value for sandals that are to be used during sports or other vigorous activities. Also, as the X-strap lies over the top of the

foot, it attaches the foot to the sole near the foot center. This is advantageous over prior art straps that attach the foot to the sole about the ankle, farther from the center of the foot.

Also, because the X-strap of the present invention attaches only to the instep of the foot and does not loop around the heel of the foot or the forefoot, it may be adjusted to snugly fit the instep. This is advantageous over some prior art strapping systems that comprised straps that encompassed other parts of the foot in addition to the instep. Unlike these prior art straps, the X-strap of the present invention will advantageously respond only to movement of the instep itself, and may be adjusted to fit only the instep. As the instep tends not to change in size significantly as the foot goes through its natural movements, this is a most advantageous location for strapping.

The present invention further encompasses footwear incorporating the aforesaid X-strap. A preferred embodiment of the footwear of the invention comprises a sandal. In addition to the X-strap of the invention, the preferred sandal embodiment further comprises a front strap for releasably attaching the sole to the forefoot, and a heel strap for releasably attaching the footwear to the wearer's heel. A pair of opposing heel posts extend upwardly from the sole from the respective medial and lateral sides of the heel portion of the sole. Desirably, the heel strap is a T-strap having a downwardly extending portion that attaches to the center, rear of the sole, behind the wear's Achilles tendon. The two ends of the X-strap are connected to the front of the lateral and medial heel posts. A side member may be preferably used that extends from the lateral heel post to the front strap to provide additional support for the foot.

The above brief description sets forth rather broadly the more important features of the present disclosure so that the detailed description that follows may be better understood, and so that the present contributions to the art may be better appreciated. There are, of course, additional features of the disclosure that will be described hereinafter which will form the subject matter of the claims appended hereto. In this respect, before explaining the several embodiments of the disclosure in detail, it is to be understood that the disclosure in not limited in its application to the details of the construction and the arrangements set forth in the following description or illustrated in the drawings. The present invention is capable of other embodiments and of being practiced and carried out in various ways, as will be appreciated by those skilled in the art. Also, it is to be understood that the phraseology and terminology employed herein are for description and not limitation.

The objects of the invention have been well satisfied. These advantages and others will become more fully apparent from the following detailed description when read in conjunction with the accompanying drawings.

Brief Description of the Figures

Figure 1 is a perspective view of a preferred embodiment of the strapping system of the invention.

Figure 2 is a detail of a fastening means of the strapping system of the present invention.

Figure 3 is a detailed medial side view of the midfoot channel of the strapping system of the invention.

Figure 4 is a bottom plan view of the midfoot channel of the strapping system of the invention.

Figure 5 is a perspective view of a preferred embodiment of the footwear of the present invention.

Detailed Description

Turning now to the drawings, Fig. 1 is a perspective view of footwear showing a preferred embodiment of the X configuration strap of the invention. The footwear is shown in phantom lines so that the location of the strap of the invention may be understood. The footwear may be of any type, including sandals as well as closed shoes. The footwear, as is conventional includes a fore foot and heel portions, with a midfoot portion there between. In accordance with the invention, a channel 31 is provided through the midfoot portion of a sole of the footwear, underlying the user's arch, as more fully explained below.

Strap 1 is attached at a first end 3 to one side, e.g., the lateral side, of the heel portion of the footwear. Strap 1 extends transversely and forwardly across and over the instep of a wearer's foot. The strap passes through the midfoot channel, entering at the medial side 5 and emerging at the lateral side 9. Strap 1 then extends in a rearward, transverse direction back across the foot instep. The strap is adjustably attached at its second end 11 to the medial side of a heel portion of the footwear.

A preferred attachment means is illustrated in Fig. 2, comprising mating hook and loop fasteners. Strap 1 passes through a pivot loop 21 attached to the heel portion of the footwear. A section of mating hooks 23 are located on the bottom of strap 1 near strap second end 11. A corresponding section of mating loops 25 are located on the top side of strap 1. Strap 1 may thereby be adjustably and removably attached to itself by pulling it through pivot loop 21 to a desired tightness and releasably fixing section of hooks 23 onto section of loops 25. Other means of attaching strap end 11 to the sole heel portion may

comprise mating female-male connectors, buckles, friction buckles, snaps, or other fasteners known in the art.

Fig. 3 is an expanded medial side view of the midfoot channel 31 in sole midfoot region 7 with strap 1 passing through. As shown in Fig. 4, midfoot channel 31 extends across the width of the midfoot region of the sole. The sole midfoot region or shank 7 is comprised of a resilient, stiff material so that midfoot channel 31 will not collapse and thereby pinch strap 1 when force is applied downwardly on the shank during use. The stiffness and resiliency of shank 7 also imparts advantageous strength and torsional rigidity to the sole. To facilitate convenient and efficient manufacture, shank 7 is preferably manufactured separate from the softer and more pliable sole and attached thereto with an adhesive or the like. Alternative methods of manufacture may be used, such a molding the shank with the other portions of the sole.

As strap 1 passes through midfoot channel 31, it acts upon the entire transverse section of the sole. When strap 1 is tightened to a desired fit it responds by forcing the entire midfoot region of the sole upwards from near its center of gravity towards the foot while simultaneously forcing the top and sides of the foot instep downward towards the sole. This results in an advantageously snug fit between sole and foot. This also provides improvement over prior art strapping systems do not attach across the entire transverse section of the sole.

Further, as strap 1 is free to shift through midfoot channel 31, a dynamic, self adjusting fit is achieved. As the foot may shift and move about during use, midfoot channel 31 allows strap 1 freedom to respond. This allows for strap 1 to maintain its fit

across the foot instep and maintenance of a correspondingly firm, responsive, and comfortable fit even during vigorous activity.

Fig. 3 shows the preferred forward angle of midfoot channel 31. Channel 31 is angled forward and downward at an angle Ø, roughly parallel to a person's instep. As the respective ends of the X-strap 1 extend upwardly and over the wearer's instep, this angle will be maintained, causing the surface of strap 1 to lie approximately flat on the sloping instep of the wearer's foot. Angling the channel in a downward and forward longitudinal direction desirably directs the respective ends of the strap 1 exiting the channel to extend in a forward and upward direction that closely matches a typical forward and upward direction that the sole is pulled by the foot while walking or running. In this manner the angling of channel 31 maximizes the ability of strap 1 to absorb forces developed during use, and provides for user comfort as strap 1 will tend to lie flat on a wearer's instep. Angle Ø is preferably between 2° and 15°, and most preferably between 3° and 6°.

Strap 1 may be fabricated from any suitable flexible material having sufficient tensile strength, such a woven fabrics or leather. A preferred strap comprises woven nylon as is well known in the art. Fabric weaves may desirably include reflective material, thereby providing 360° reflectivity for enhanced user safety.

The present invention encompasses footwear having the aforesaid X-strap. Fig. 5 is a preferred embodiment of the footwear of the invention comprising a sandal. It should be noted, however, that the features of the invention are equally applicable to closed footwear such as shoes. Strap 41 has a first end 43 attached to a heel post 45. Strap 41 passes over a wearer's instep and into midfoot channel 47. Channel 47 extends

transversely through sole 51. After exiting channel 47, strap 41 passes back over the foot instep, through midfoot loop 53, and into fastener 55 for adjustable fastening strap 41 to heel post 57. Strap 41 thereby forms an X-shaped configuration over the wearer's instep. Fastener 55 may comprise a buckle with lever as illustrated, or other means as are known in the art, including, for example, hook and loop fasteners, male-female connectors, buckles, snaps, and the like.

Sole midfoot region 49 is preferably fabricated from a resilient and relatively stiff material to provide desirable torsional rigidity to the softer and more pliable sole 51. Because sole midfoot region 49 is comprised of a resilient plastic material while sole 51 is comprised of a softer, more pliable material; sole midfoot region 49 is preferably manufactured separate from sole 51 and then affixed to sole 51 using adhesives or the like. A generally stiff, resilient sole midfoot region 49 desirably adds stiffness and torsional rigidity to sole 51. ~~Sole 51 is constructed as generally known in the art, and may, for example, be comprised of a relatively tough and wear resistant outsole, a softer and more cushioned midsole, and a soft topsole or footbed for contact with the user foot.~~ Sole 51 is preferably molded of ethylene vinyl acetate.

As the midfoot portion of the sole or shank is formed of stiff material, channel 47 will not collapse and pinch strap 41 while the footwear is in use. Thereby strap 41 will move freely through the channel. As discussed *infra*, movement of strap 41 during use is most desirable to provide for a secure, dynamic, and self adjusting fit, even during vigorous activity.

Channel 47 is also angled forward and downwardly from the horizontal to provide the advantages discussed *infra*, including maximizing user comfort and absorbing forces developed during walking and running.

Adjustable heel strap 59 for securing a wearer's heel to the footwear is attached at a first end 61 to medial heel post 45, and a second end to lateral heel post 57. Heel strap 59 second end 63 extends through heel loop 65, and through heel fastening means 67. Means 67 may comprise any of several fastening means that are well known in the art, including, for example, a lever operated buckle as illustrated, mating hooks and loops, mating male/female buckles, snaps, or the like. Heel strap 59 desirably may be provided with a downwardly extending T-strap member (not shown) that attaches to the center, rear of the sole. If a T-strap is utilized, it is desirable to provide heel strap fasteners at both the lateral and medial heel posts so that the wearer may custom adjust the T-strap as desired.

The footwear further includes a lateral side member 59 and forefoot strap 69. Lateral side strap 59 extends between heel post 57 and forefoot strap 69. Forefoot strap 69 adjustably secures a wearer's forefoot to sole 51. Forefoot strap 69 is adjustably tightened through front loop 71, and fastens back onto itself through fastener 73. Fastener 73 may comprise any of the several fastening means as known in the art, including, for example, mating hook and loop fasteners, buckles, and the like.

The advantages of the disclosed inventions are thus attained in an economical, practical, and facile manner. While preferred embodiments and example configurations have been shown and described, it is to be understood that various further modifications

and additional configurations will be apparent to those skilled in the art. It is intended that the specific embodiments and configurations herein disclosed are illustrative of the preferred and best modes for practicing the invention, and should not be interpreted as limitations on the scope of the invention as defined by the appended claims. For example, although a sandal has been presented as a preferred embodiment of the footwear of the present invention, the present invention may be practiced in an embodiment comprising an athletic shoe within the scope of the following claims as will be appreciated by those skilled in the art.